

Automatic Tank Gauging System: A Next Generation Tool for UST

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Abstract — A settlement between the United States and Total Petroleum Puerto Rico Corp was agreed to improve leak detection in their gas service stations. The automatic tank gauging with a centralized monitoring system is the method selected to improve the leak detection. It is regulated by the U.S. Environmental Agency and the P.R. Environmental Quality Board. The ATG system is cover under the Next Generation Tool Policy under the USEPA. The system was studied in an effort to identify the regulation and specification for the installation, operation and maintenance to initiate a conceptual program. The system is promoted by the state and federal agencies. It can provide centralized real time monitoring information, inventory control, a non-destructive leak detection test, and can be operated by an operator class C The installation cost fluctuates between \$28,000 and 34,000.00.

Key Terms — ATG, UST ATG system, UST Automatic tank gauging, UST release detection

INTRODUCTION

Gas service stations have underground storage tanks (UST). They are used to store gasoline or diesel. A leaking UST can affect water supplies, surface water and groundwater, in different communities. The number of underground storage tanks in Puerto Rico is 4,491 as of March 31, 2015. The number of confirmed releases is 1,068. The number of clean-ups (corrective actions) completed is 499. The information is provided by the Office of Underground Storage Tank (OUST), of the U.S. Environmental Protection Agency (USEPA) [1]. State and federal regulations have been approved to protect the water supply. The USEPA and the P.R. Environmental Quality Board (PREQB) are federal

and state organization in charge of implementing the regulations.

A settlement between the United States and Total Petroleum Puerto Rico Corp (Total Puerto Rico) was announced. “Total Puerto Rico agreed to spend \$1.6 million to improve leak detection in at least 125 gas stations across Puerto Rico and U. S. Virgins Islands” [2]. Also, Chevron Puerto Rico had a settlement to install a release detection system with a centralized monitoring in 2011.

The UST regulation requires the installation of a release detection system such as manual tank gauging, automatic tank gauging system (ATG), statistical inventory control, tightness test and others. The ATG system is the method to be analyzed in the next sections as leak detection system to be installed in a gas service station. Figure 1 illustrates an ATG system for USTs. This method uses automated processes to monitor product level and inventory control.

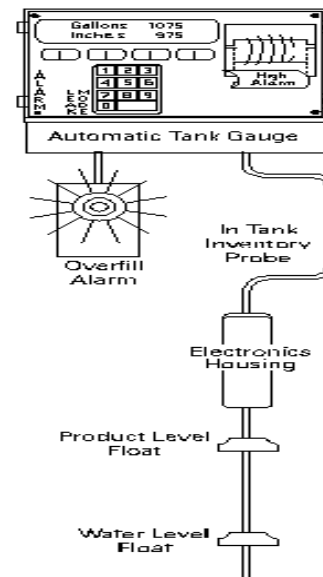


Figure 1
Basic components of an ATG system [3]

This paper was based in the Total Petroleum settlement announcement. Its purpose is to evaluate the ATG system and its programs such as installation, operation and maintenance. The state and federal regulation covers the implementation of those programs. ATG systems provides several alternatives to be applied in a gas service station. A proposal of an ATG System is presented.

LITERATURE REVIEW

The different sources of information about automatic tank gauging (ATG) are related mainly to the regulation. The USEPA is responsible of keeping compliance with the 40 CFR 280 that provides the regulation about underground storage tanks (UST). The rule 40CFR280.45 [4] is about ATG. In general, the 40CFR280 was created between 1989 and 1990, and it has not suffer changes.

The PR Environmental Quality Board (PREQB) is responsible of the state regulation about UST. The state regulation was subjected to changes. The Regulation for the Control of Underground Storage Tanks was originally approved in 1990 [5]. The regulation was amended and approved in 2014. Both regulations provide rules about the construction or installation, operation and maintenance. The new regulation provides several amends to UST rules, including release detection and ATG. One of the purposes of the amends is to implement the permanent use of ATG, other release detection methods or a combination between them. The regulation cited: "The methods mentioned in Rule 831 (B)-(D) must be discontinued within three (3) years of the effective date of this Regulation and an alternate method from Rule 831 (E)-(J) shall be implemented" [5]. The ATG is covered by the Rule 831-G.

The USEPA announced an agreement with Total Petroleum Corp. in Puerto Rico related to the UST located in their gas service station. Those gas service stations are located around the Island. The agreement considers the implementation of ATG in

all of the UST in the gas service station. Chevron Puerto Rico was the other company that achieved a settlement with the USEPA about ATG in 2011. This is according with the new regulation implemented by the PREQB, and the Next Generation Tool Policy for UST of USEPA. The announcement cited the Regional U.S. Administrator saying the following words: "Leaking underground petroleum tanks are a serious problem because they can contaminate groundwater with pollutants such as benzene, which is known to cause cancer," said Regional Administrator Judith Enck from USEPA. "This agreement includes an innovative centralized monitoring system, which will protect the environment by helping to ensure that the underground tanks at many gas stations across Puerto Rico and in the U.S. Virgin Islands will now be properly monitored and maintained" [2].

The USEPA developed a guideline for ATG for inspectors. The guideline provides all the information necessary about ATG. The document explain the different leak detection systems with special emphasis in ATG, and how to educate the owners/operators by the inspectors. The guidelines cites who can use it: "The following pages present "system descriptions" of automatic tank gauging (ATG) systems used to monitor release detection at underground storage tanks (USTs). As an UST inspector, you can use this information to evaluate systems and to educate UST owners/operators. Each description of an ATG system provides information on how the equipment works, its specifications and limitations, its operation and maintenance requirements, and how to print and read reports" [6].

The ATG equipment to be selected shall be subject to the manufacturer's specifications. The manufacturer provides the steps to be followed through the installation, operation, maintenance and warranties of the equipment.

The information obtained from the federal and state regulation and the USEPA's announcement of the settlement with Total Petroleum Corp., the USEPA guidelines for ATG, and the

manufacturer's specifications are the background information to develop the installation, operation and maintenance programs.

PROJECT STATEMENT

A petroleum company in Puerto Rico agrees to improve leak detection in several service stations. The agreement undertake a supplemental environmental project (SEP) consisting of an ATG system with a centralized monitoring system that provide surveillance to gas service stations from a single point. The objective is to identify the regulation and specification for an UST ATG system and to present a conceptual program related to the installation, operation and maintenance.

METHODOLOGY

To achieve compliance with the regulation and the ATG system programs is necessary to:

- Review the actual federal and state regulations.
- Select an ATG system alternative.
- Estimate a conceptual cost and time for a service station.
- Propose an operation and maintenance inspection.

ANALYSIS

A typical gas service station has three underground storage tanks (UST). Two UST are used to store gasoline, and one for diesel. The storage capacity of the UST is typically between 3,000 and 12, 000 gallons. Each UST system is composed of tanks, pipes and ancillary equipment, as seen in Figure 2. They are located in a pit limited by a fill material, natural subsoil and closely or in contact to groundwater in some places.

A leaking UST can affect water supplies, surface water and groundwater in different communities. State and federal regulations have been approved to protect the water supply. The purpose of UST regulation is to enforce the installation, operation, maintenance and corrective action concerning with leaks and spills. This is in

order to protect the human health and it environment.

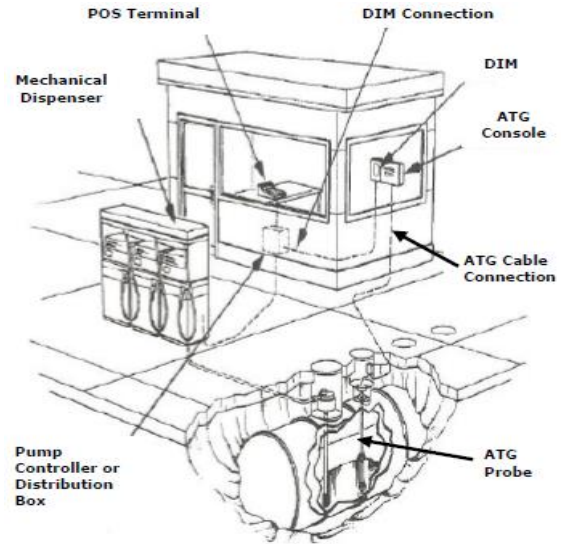


Figure 2
Gas service station with an ATG system for UST [7]

Two companies had a settlement with the U.S. Court and the USEPA in the past years to install a release detection system such as automatic tank gauging with a centralized monitoring system, a Next Generation technology. Total Petroleum Puerto Rico and Chevron Puerto Rico were those companies. The ATG system serves to, “rapidly identify and respond to actual or potential gas leaks at its gas stations with actively operating USTs, each of which will be equipped with on-site electronic release detection monitoring equipment that will be enhanced with the Next Generation capability to transmit monitoring data to one central location on a 24/7/365 basis” [2].

The UST regulation requires the installation of a leak detection system such as manual tank gauging, automatic tank gauging system (ATG), statistical inventory reconciliation, tightness test and others. The ATG system is the leak detection method selected to be installed in gas service stations. It functions are used for inventory control, water detection, and leak detection among others. The system has microcontrollers that monitor tanks employing probes and sensors. Several gas service stations can be monitored from a centralized offsite monitoring center via networking, see Figure 3.

This can be done using a software and an internet connection. The data can be obtained in real time. It can perform continuous monitoring testing and send e-mail alerts from the ATG.

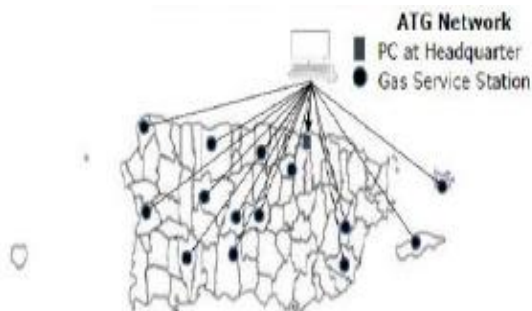


Figure 3
Illustration of an ATG network for UST

The installation requires a modification permit from the Environmental Quality Board, a contractor certified by the manufacturer and a broadband internet connection. The main equipment includes an ATG console, a 120 VAC electric control box, probes, sensors, dispenser interface module (DIM), distribution box, point of sale (POS), and a router. Figure 2 [7] shows a typical installation of the equipment.

The estimated installation cost is between \$28,000 and \$34,000 for three UST. The cost considers inventory control and leak detection probes for the tanks.

The operation and maintenance program is influenced by the UST Regulation. The PREQB UST Control Regulation requires that operators have to be certified at levels A, B or C. They need to take a training and a test about UST system and regulation. The first line of operation and maintenance is attended by the employee at the gas service station. The employee shall take the training for operator level C. The operator shall perform a daily inspection of the ATG console. The operation manual shall be kept at one side of the ATG console at all time. The first step is to perform a daily visual inspection of the ATG console, then it is completed with a check of the actual mode of the system, test the alarm and printer, print a status report, keep a daily record of inspection, and report any alarm notification to an operator level A or B

for immediate action. The operator class A or B are responsible to take decisions and resolve any situation related to the UST, and to notify regulatory agencies about a release or a spill in the service station. The supervisors, managers and owners are operator class A or B.

An inventory report, printout, provides the following information: date, hour, tank no., product level, product volume, ullage volume (empty space), 90% ullage (to order product), water level, water volume, and temperature. It is used to know the actual amount of product and to program the delivery of products by headquarter or to be ordered by the dealer. The report also serves as a status report of the ATG system after performing a tightness test. The operation manual shall be kept at one side of the ATG console at all time.

A leak rate report provides the following information: date, hour, tank no., product, probe serial number, test starting time, test length, start volume, and leak rate test result (leak rate, pass or fail). The system can perform a line and leak detector test, if it is provided with the modules and sensors to perform it. The UST and lines are tested at the frequency programmed.

RESULTS

The state regulation promulgated by the Environmental Quality Board has the primacy jurisdiction about the underground storage tanks in Puerto Rico. It regulates the installation, operation and maintenance of UST. The regulation requires a UST Permit Modification submittal previous to the installation. The installation cost of the automatic tank gauging system for three underground storage tanks is between \$28,000 and \$34,000. An installation contractor of the ATG system must be certified by the manufacturer. The estimated time to install the equipment are two weeks. A daily inspection and record keeping can be performed by an operator level C after being properly trained. The ATG system can be used for inventory control of product and leak detection. A centralized monitoring system can be used using a software

and internet connection. It can be implemented from headquarter or the desire location to monitor the notification alarms, perform leak detection test, and inventory management.

DISCUSSION

The automatic tank gauging equipment has multiple features more than inventory control and leak detection. It is a versatile equipment used to detect vapors and free product in wells, sump dispensers, and sump risers. Also, it is used as a leak detection method for pipes. Exists several trademarks and models of ATG that can satisfy any situation or case at different cost.

An UST equipment inventory must be performed to know the actual needs of a gas service station, and especially in the case of a company with a network. The right selection of ATG equipment and the quantity to be order must be based in the equipment inventory. The quantity could serve to negotiate a reasonable price and to obtain a saving from an authorized distributor or manufacturer. Some ATG equipment could be out of service and could be upgraded providing some saving to the UST's owner.

The ATG is an alternative between others approved by the regulatory agencies. It is more expensive than other leak detection method. However, it can provide more reliability as leak detection method because a daily test or follow up of the UST system can be performed. The risk of a product release can be decreased significantly with the constant watching. This is a great different over other leak detection methods.

A company can implement a centralized monitoring system from any point or peripheral (computer, tablet or smartphone), using only a software and internet connection. Large companies has the infrastructure to establish a centralized system. A small company or a single service station needs to make an economic analysis to select the right choice of leak detection method or a combination.

CONCLUSION

The automatic tank gauging for underground storage tanks can:

- Provide real time monitoring information.
- Improve regulatory compliance.
- Reduce the risk of a product release.
- Control product delivery through inventory management.
- Perform a non-destructive leak detection test.
- Be created centralized monitoring system for a network of service stations.
- Adjust to the needs of the UST owner.

The system is promoted by the state and federal agencies. The installation cost fluctuates between \$28,000 and \$34,000.00 in one gas service station.

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